MarTREC
Maritime Transportation Research & Education Center

MarTREC UTC Project Information Form
USDOT Tier 1 University Transportation Center
Agency ID or Contract Number DTRT13-G-UTC50

Project Title: Innovative Bio-Mediated Particulate Materials for Sustainable Maritime Transportation Infrastructure
Project Abstract (Brief Description): Innovative bio-mediated particulate materials may provide great and previously unexplored opportunities as cost-effective and sustainable construction materials for maritime transportation infrastructure. To address this need, and building upon its experience and expertise in the area, this project propose multidisciplinary effort to evaluate the mechanical properties of bio-mediated sandy soils attributable to the formation of microbially-induced calcite precipitation. The mechanical properties of sandy soils in the coastal area often do not satisfy construction expectation for maritime transportation infrastructure. The salty, loose sand makes it difficult for quick construction of port, building and roadway. Sometimes the weakness and unpredictability of soil properties can lead to unexpected collapse. Biological techniques, such as microbially-induced calcite precipitation (MICP), can provide unexplored opportunities for cost-effective, in situ improvement of the engineering properties of sandy soil. As one of the natural process in mineral precipitation, MICP by urea hydrolysis can result in relatively insoluble compounds contributing to soil cementation. Previous research and testing has focused almost exclusively on the standard Ottawa sands due to its uniform pore size. As a result, little is known on the more problematic cases of sandy soils in the coastal area for the bio-mediated soil improvement. The much finer structure and salty condition are two unknown factors for the MICP.
Describe Implementation of Research Outcomes: The results of this study show that microbial induced calcite precipitation (MICP) treated material was weak at wet-dry durability and freeze-thaw durability. MICP-treated beach sand material was better at resisting these two weather conditions possibly because of its irregular shaped particles.
Impacts/Benefits of Implementation: The use of fiber or multiple treatments during the MICP treatment can provide resistance to the weathered deteriorations of MICP-treated soil. The MICP treatment establishes a cost-effective and in situ improvement of the engineering properties of sandy soils in coastal area for maritime transportation infrastructure construction.
Web Links: https://martrec.uark.edu/
Budget (Funding) Amounts & Source(s) (US DOT +Match(s) =Total Costs): 57.5k USDOT + 28.75k matching = 86.25k total
Project Start and End Dates: 11/01/2015 – 06/30/2017. A no cost 6 month extension was granted. Project complete.
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